IN THE CLAIMS:

1.-38. (Canceled)

39. (Currently Amended) A method of forming a silicon and nitrogen containing dielectric barrier layer comprising a first sub-layer containing silicon and nitrogen, a second sub-layer containing silicon and nitrogen, and an intermediate sub-layer containing silicon and nitrogen positioned between said first and second sub-layers, the method comprising:

providing a structure comprising an exposed copper surface; and

performing ~~a single~~ at least one deposition process to form ~~a single silicon nitride layer on~~ said first, second and intermediate sub-layers above said exposed copper surface, said ~~single silicon nitride layer~~ first sub-layer having a first surface that interfaces with said exposed copper surface, said intermediate layer having a surface that interfaces with said first sub-layer, said second sub-layer having a first surface that interfaces with said intermediate layer and a second surface that is opposite said first surface of said second sub-layer, wherein the parameters of said at least one deposition process are adjusted such that a concentration of silicon in said ~~single silicon nitride layer gradually increases from said first surface to said second surface~~ first sub-layer is less than a concentration of silicon in said second sub-layer.

40. (Currently Amended) The method of claim 39, wherein said at least one deposition process is a single deposition process that is performed without interrupting a vacuum.

41. (Currently Amended) The method of claim 39, wherein said ~~single silicon nitride layer is formed while changing a first set of deposition parameters to a second set of deposition parameters~~ concentration of silicon in said first sub-layer is substantially constant throughout its thickness, said concentration of silicon in said second sub-layer is substantially constant throughout its thickness, and a concentration of silicon in said intermediate sub-layer increases in the direction from its interface with the first sub-layer to its interface with the second sub-layer.

42. (Currently Amended) The method of claim 39, wherein performing said ~~single~~ at least one deposition process comprises performing said at least one deposition process with a first set of a deposition parameters to form said first sub-layer and transitioning to performing said at least one deposition process with a second set of deposition parameters that are different from said first set of deposition parameters to thereby form said second sub-layer.

43. (Previously Presented) The method of claim 42, wherein said first and second set of deposition parameters include at least one of a silane flow rate and an ammonia flow rate.

44. (Currently Amended) The method of ~~claim 42~~ claim 41, wherein ~~said single silicon nitride layer is deposited in a plasma ambient~~ a stoichiometric ratio of silicon to nitrogen at said first surface of said first sub-layer is within the range of approximately 0.2-0.45.

45. (Currently Amended) The method of claim 39, further comprising treating said exposed copper surface by exposing the copper surface to a plasma ambient prior to forming said ~~single silicon nitride layer~~ first sub-layer.

46. (Currently Amended) The method of claim 45, wherein treating said exposed copper surface and forming said ~~single silicon nitride layer~~ first, second and intermediate sub-layers is performed without interrupting a vacuum established over said exposed copper surface.

47. (Currently Amended) The method of ~~claim 39~~ claim 44, wherein ~~performing said single deposition process comprises performing said deposition process using a silane flow rate of approximately 120-170 sccm and a nitrogen flow rate of approximately 220-330 sccm and transitioning to performing said deposition process using a silane flow rate of approximately 200-250 sccm and a nitrogen flow rate of approximately 30-80 sccm~~ a stoichiometric ratio of silicon to nitrogen at said second surface of said second sub-layer is within the range of approximately 0.45-0.8.

48. (Currently Amended) A method of forming a silicon and nitrogen containing dielectric barrier layer comprising a first sub-layer containing silicon and nitrogen, a second sub-layer containing silicon and nitrogen, and an intermediate sub-layer containing silicon and nitrogen positioned between said first and second sub-layers, the method comprising:

providing a structure comprising an exposed copper surface;

treating said exposed copper surface by exposing the copper surface to a plasma ambient; and

after treating said exposed copper surface, performing ~~a single~~ at least one deposition process to form ~~a single silicon nitride layer on~~ said first, second and intermediate sub-layers above said exposed copper surface, said ~~single silicon nitride layer~~ first sub-layer having a first surface that interfaces with said exposed copper surface, said intermediate layer having a surface that interfaces with said first sub-layer, said second sub-layer having a first surface that interfaces with said intermediate layer and a second surface that is opposite said first surface of said second sub-layer, wherein the parameters of said at least one deposition process are adjusted such that a ~~concentration of silicon in said single silicon nitride layer gradually increases from said first surface to said second surface~~ concentration of silicon in said first sub-layer is substantially constant throughout its thickness, said concentration of silicon in said second sub-layer is substantially constant throughout its thickness, the concentration of silicon in said second sub-layer being greater than the concentration of silicon in said first sub-layer, wherein the step of treating said exposed copper surface and performing said ~~single~~ at least one deposition process ~~to form said single silicon nitride layer~~ are performed without interrupting a vacuum established over said exposed copper surface.

49. (Currently Amended) The method of claim 48, wherein ~~said single silicon nitride layer is formed while~~ performing said at least one deposition process comprises changing a first set of deposition parameters to a second set of deposition parameters.

50. (Currently Amended) The method of claim 48, wherein performing said ~~single~~ at least one deposition process comprises performing said at least one deposition process with a first set of a deposition parameters to form said first sub-layer and transitioning to performing said at least one deposition process with a second set of deposition parameters that are different from said first set of deposition parameters to thereby form said second sub-layer.

51. (Currently Amended) The method of ~~claim 50~~ claim 48, wherein ~~said first and second set of deposition parameters include at least one of a silane flow rate and an ammonia flow rate~~ a concentration of silicon in said intermediate sub-layer increases in the direction from its interface with the first sub-layer to its interface with the second sub-layer.

52. (Currently Amended) The method of ~~claim 50~~ claim 48, wherein ~~said single silicon nitride layer is deposited in a plasma ambient~~ a stoichiometric ratio of silicon to nitrogen at said first surface of said first sub-layer is within the range of approximately 0.2-0.45.

53. (Currently Amended) The method of ~~claim 48~~ claim 52, wherein ~~performing said single deposition process comprises performing said deposition process using a silane flow rate of approximately 120-170 sccm and a nitrogen flow rate of approximately 220-330 sccm and transitioning to performing said deposition process using a silane flow rate of approximately 200-250 sccm and a nitrogen flow rate of approximately 30-80 sccm~~ a stoichiometric ratio of silicon to nitrogen at said second surface of said second sub-layer is within the range of approximately 0.45-0.8.

54. (Currently Amended) A method of forming a silicon and nitrogen containing dielectric barrier layer comprising a first sub-layer containing silicon and nitrogen, a second sub-layer containing silicon and nitrogen, and an intermediate sub-layer containing silicon and nitrogen positioned between said first and second sub-layers, the method comprising:

providing a structure comprising an exposed copper surface; and

treating said exposed copper surface by exposing the copper surface to a plasma ambient;

after treating said exposed copper surface, performing a single deposition process in which deposition parameters are changed to form ~~a single silicon nitride layer on~~ said first, second and intermediate sub-layers above said exposed copper surface, said ~~single silicon nitride layer~~ first sub-layer having a first surface that interfaces with said exposed copper surface, said intermediate layer having a surface that interfaces with said first sub-layer, said second sub-layer having a first surface that interfaces with said intermediate layer, and a second surface that is opposite said first surface of said second sub-layer, wherein said parameters of said deposition process ~~is performed with a first set of a deposition parameters and thereafter performed with a second set of deposition parameters that are different from said first set of deposition parameters such that a concentration of silicon in said single silicon nitride layer gradually increases from said first surface to said second surface~~ are changed such that a concentration of silicon in said first sub-layer is substantially constant throughout its thickness, said concentration of silicon in said second sub-layer is substantially constant throughout its thickness, and a concentration of silicon in said intermediate sub-layer increases in the

direction from its interface with the first sub-layer to its interface with the second sub-layer, wherein a stoichiometric ratio of silicon to nitrogen at said first surface of said first sub-layer is within the range of approximately 0.2-0.45, and wherein a stoichiometric ratio of silicon to nitrogen at said second surface of said second sub-layer is within the range of approximately 0.45-0.8.

55. (Previously Presented) The method of claim 54, wherein said single deposition process is performed without interrupting a vacuum.

56. (Currently Amended) The method of claim 54, wherein ~~said first and second set of deposition parameters include at least one of a silane flow rate and an ammonia flow rate~~ the concentration of silicon in said second sub-layer is greater than the concentration of silicon in said first sub-layer.